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SYSTEMS AND METHODS FOR COMMUNICATING BETWEEN A DECISION-SUPPORT SYSTEM AND ONE OR MORE MOBILE INFORMATION DEVICES

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BACKGROUND OF THE INVENTION

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1. The Field of the Invention

3 This invention relates to decision-making processes where information is analyzed
4 to provide an individual with one or more suggested solutions or actions. More
5 specifically, the present invention relates to transferring and synchronizing medical data
6 between a decision-making medical system and one or more mobile information devices
7 used by clinicians, thereby aiding a clinician to more efficiently treat patients than is
8 currently possible.

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2. The Prior State of the Art

10 The U.S. health care delivery system has undergone breathtaking changes since the
11 late 1980's. Escalating costs, diminishing resources, demands for accountability
12 characterize today's medical marketplace, inescapable conflicts regarding meaningful
13 outcomes measures, and an expanding medical knowledge base.

14 Health care is an information intensive industry and the delivery systems typically
15 used within hospitals and clinics are drowning in data while starving for information. It is
16 no exaggeration to describe the current health care delivery system as undergoing an
17 information revolution. Increasingly providers and health care researchers experience
18 demands for more accurate and accessible information. The complexity of health care, its
19 burgeoning information base, and the turbulence of the medical marketplace have all
20 contributed to a system grappling with methods to efficiently synthesize and disseminate
21 information, standardize care, and to continue to create and innovate. The obstacles to
22 these goals are the same regardless of whether the health care delivery entity is a small
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1 hospital, long-term/skilled nursing facility, medical clinic, home health agency, hospice,
2 emergent care unit, or large institution. The frustrations and barriers are faced equally
3 whether the affiliation is academic public or private, managed care or fee-for-service, not-
4 for-profit or for profit. All entities are faced with the need to identify strategies and
5 solutions to manage information and make better decisions, whether those decisions are
6 medical or business-related in nature.

7 Of particular interest to the demands of the ever increasing need for more accurate
8 and accessible information is the area of clinical decision-making. Clinical decisions are
9 of particular interest since they often influence the balance of human suffering and well-
10 being. Clinical decisions, not unlike all human decisions, are complex and influenced by
11 many causal relationships. These relationships include the evidence-base of medicine,
12 patient-physician factors and interactions, and external and internal constraints. Whether
13 clinicians are serving individual patients or populations they have always sought to base
14 their decisions on the best available evidence. This simple tenet has been confounded by
15 the continual expansion of medicine's evidence-base. The rapid expansion of the scientific
16 and clinical evidence has changed the health care landscape so that no longer is the
17 question how much of medical practice is based in evidence, but rather how much of the
18 available evidence is applied at the front lines of patient care.

19 One front line of patient care involves the daily visit of a clinician to each patient
20 under he or she's care, commonly termed "rounds". A clinician, or subordinate clinician,
21 visits each patient and views the current medical condition of the patient, typically,
22 represented by vital statistics and other information contained within paper charts.
23 Commonly, the subordinate clinician must prepare to report the progress of the patient by

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1 providing a medical history of the patient and current medical information, with suggested
2 treatments. The "rounds" process is time consuming and complex since each patient will
3 typically have different medical conditions influenced by a large number of different
4 factors, such as demographics, family history or genetic background, occupational
5 influences, and the like. To properly diagnose and treat each patient a clinician and/or
6 subordinate clinicians must understand the nuances of the medical condition of each
7 patient, and respond accordingly to variations in the current medical condition of the
8 patient. Additionally, the clinician and subordinate clinician must maintain his or her
9 knowledge base with the ever-changing medical and scientific knowledge base.

10 Although clinicians maintain a high knowledge base of medical information,
11 clinician's are human and sometimes may not recognize signals or medical information
12 that suggests a medical condition unrelated to the medical condition for which the patient
13 was admitted. Such error in judgment or misinterpretation of medical information may
14 result in increased patient stay in the medical facility or possibly patient death.

15 Clinicians are, therefore, influenced by a number of complex and varied constraints
16 during the decision-making process of how to treat a patient's medical condition. Such
17 constraints involve the factors of time, community standards, formal policies and laws, and
18 the issues of reimbursement. Add to these constraints the need to for the clinician to
19 maintain his or her knowledge base with the ever-changing medical and scientific
20 knowledge base, and it is obvious that clinicians attempt to make informed medical
21 decisions under difficult conditions.

1 It would be an advance to provide methods and systems to aid the clinician in
2 providing an informed and accurate medical decision for each specific patient under his or
3 her care that has a basis in the most current medical and scientific knowledge.

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SUMMARY OF THE INVENTION

It is an object of the present invention to provide a system and method for accessing medical information in an efficient and controllable manner.

It is another object of the present invention to provide a system and method for presenting a clinician with medical information in a manner controlled by the clinician.

Another object of the present invention is to provide a system and method that conveys medical information in a concise manner that aids a clinician in diagnosing and treating medical conditions.

Yet another object of the present invention is to provide a system and method for summarizing the current medical status of a patient based upon the most current medical information and the patient's previous medical history.

Still yet another object of the present invention is to provide a system and method for synchronizing the medical information gathered by a clinician with existing medical information of the patient.

Another object of the present invention is to provide a system and method for updating a personal digital assistant with summarized patient data specific to those patient's that a clinician is to examine within and definable period of time.

Yet another object of the present invention is to provide a system and method to synchronize proscribed medications and administered treatments with the various related departments within a medical facility.

Still yet another object of the present invention is to provide a system and method to allow real-time communication between a decision supporting system and a clinician to aid the clinician in making informed decisions related to patient medical care.

1 Additional objects and advantages of the invention will be set forth in the
2 description which follows, and in part will be obvious from the description, or may be
3 learned by the practice of the invention. The objects and advantages of the invention may
4 be realized and obtained by means of the instruments and combinations particularly
5 pointed out in the appended claims. These and other objects of the present invention will
6 become more fully apparent from the following description and appended claims, or may
7 be learned by the practice of the invention as set forth hereinafter.

8 As disclosed previously, clinicians are influenced by a number of complex and
9 varied constraints during the decision-making process of how to treat multiple patients
10 each having varied medical conditions. Each clinician must maintain a large personal
11 knowledge base to provide medical care to a variety of different patients with varied family
12 histories and backgrounds. Although clinicians typically educate themselves, during the
13 rigors of the performing medical care, such knowledge may not raise to the clinician's
14 memory. To achieve the foregoing objects, and in accordance with the invention as
15 embodied and broadly described herein, systems and methods for providing clinicians with
16 recommended and suggested medical care that is based upon a large expert knowledge
17 base and specific to each patient that a clinician may visit, termed decision-support patient
18 data, is disclosed.

19 In one embodiment, a method for delivering decision-supported patient data of a
20 patient to a user module accessible by a clinician in a controlled and repeatable manner is
21 disclosed. The method includes the steps of analyzing patient data to identify current
22 patient data of each patient that a clinician is to examine in a defined time period. Such

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1 current patient data may include general health information like blood pressure and heart
2 rate and/or medical condition specific data such as blood sugar level for a diabetes patient.

3 The current patient data is evaluated with the expert knowledge of a knowledge
4 base to generate decision-supported patient data for each patient that is to be examined
5 within the defined time period. As referenced-above, the decision-supported patient data
6 provides the clinician with potential medical conditions that the patient may have and
7 recommendations for medical care.

8 Once the current patient data and other medical history data and information are
9 evaluated, the decision-supported patient data is presented to the clinician in a
10 configuration that assists the clinician in treating each patient. The displayed data provides
11 the clinician with the pertinent information related to the patient's existing and potential
12 medical condition and the medical care to be implemented by the clinician. For example,
13 the display may include warnings related to a particular recommended treatment for a
14 specific patient.

15 Such method may be performed in real-time so that the clinician may receive
16 updated decision-supported patient data from a decision-support module and/or medical
17 module. In this manner the clinician is aided in making informed decisions related to
18 patient medical care.

19 One of the modules implemented by one embodiment of the present invention is a
20 decision-support module. The decision-support module generates decision-supported
21 patient data specific to each patient that a clinician is to examine in a defined time period.
22 The decision-support module includes a knowledge module that stores data representative
23 of expert knowledge within the medical field. Such expert knowledge is gleaned from

1 various sources and experts in a variety area of the medical field. The decision-support
2 module also includes a patient module that stores patient specific data. Communicating
3 with the knowledge module and the patient module is an inference engine that generates
4 the decision-supported patient data based upon the information and data stored in the
5 knowledge module and the patient module.

6 Another module of the present invention is a user module. The user module
7 communicates with the decision-support module and allows the decision-supported patient
8 data to be presented to the clinician in a configuration that assists the clinician in treating
9 each patient. The user module may have various other modules that allow the decision-
10 supported patient data and other patient specific data to be stored therein and accessed by
11 the clinician as a clinician makes a determination as to the medical care to proscribe for
12 each patient that the clinician examines.

13 In this manner, the present invention is capable of using various user modules to
14 effectively provide decision-supported patient data to a clinician in a configuration that
15 assists the clinician in making a decision related to medical care of a patient.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the manner in which the above-recited and other advantages and features of the invention are obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof that are illustrated in the appended drawings. Understanding that these drawing depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 illustrates an exemplary system that provides a suitable operating environment for the present invention;

Figure 2 is a schematic representation of one embodiment of the system of the present invention;

Figure 3 is a more detailed schematic representation of the system of Figure 2; and

Figure 4 is a flow diagram illustrating the flow of data in the system of Figures 2 and 3.

DETAILED DESCRIPTION OF THE INVENTION

The present invention extends both methods and systems for updating and gathering data from a database through the use of hand held-technologies. The embodiments of the present invention may comprise a special purpose or general purpose computer including various other computer hardware and/or software modules and components, as discussed in greater detail below.

Embodiments within the scope of the present invention also include computer-readable media for carrying or having computer-executable instructions or data structures stored thereon. Such computer-readable media can be any available media that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to carry or store desired program code means in the form of computer-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer. When information is transferred or provided over a network or another communications connection (either hardwired, wireless, or a combination of hardwired or wireless) to a computer, the computer properly views the connection as a computer-readable medium. Thus, any such a connection is properly termed a computer-readable medium. Combinations of the above should also be included within the scope of computer-readable media. Computer-executable instructions comprise, for example, instructions and data which cause a general purpose computer, special purpose computer, or special purpose processing device to perform a certain function or group of functions.

1 Figure 1 and the following discussion are intended to provide a brief, general
2 description of a suitable computing environment in which the invention may be
3 implemented. Although not required, the invention will be described in the general context
4 of computer-executable instructions, such as program modules, being executed by
5 computers in network environments. Generally, program modules include routines,
6 programs, objects, components, data structures, etc. that perform particular tasks or
7 implement particular abstract data types. Computer-executable instructions, associated
8 data structures, and program modules represent examples of the program code means for
9 executing steps of the methods disclosed herein. The particular sequence of such
10 executable instructions or associated data structures represents examples of corresponding
11 acts for implementing the functions described in such steps.

12 Those skilled in the art will appreciate that the invention may be practiced in
13 network computing environments with many types of computer system configurations,
14 including personal computers, hand-held devices, multi-processor systems,
15 microprocessor-based or programmable consumer electronics, network PCs,
16 minicomputers, mainframe computers, and the like. The invention may also be practiced
17 in distributed computing environments where tasks are performed by local and remote
18 processing devices that are linked (either by hardwired links, wireless links, or by a
19 combination of hardwired or wireless links) through a communications network. In a
20 distributed computing environment, program modules may be located in both local and
21 remote memory storage devices.

With reference to Figure 1, an exemplary system for implementing the invention includes a general purpose computing device in the form of a conventional computer 20,

1 including a processing unit 21, a system memory 22, and a system bus 23 that couples
2 various system components including the system memory 22 to the processing unit 21.
3 The system bus 23 may be any of several types of bus structures including a memory bus
4 or memory controller, a peripheral bus, and a local bus using any of a variety of bus
5 architectures. The system memory includes read only memory (ROM) 24 and random
6 access memory (RAM) 25. A basic input/output system (BIOS) 26, containing the basic
7 routines that help transfer information between elements within the computer 20, such as
8 during start-up, may be stored in ROM 24.

9 The computer 20 may also include a magnetic hard disk drive 27 for reading from
10 and writing to a magnetic hard disk 39, a magnetic disk drive 28 for reading from or
11 writing to a removable magnetic disk 29, and an optical disk drive 30 for reading from or
12 writing to removable optical disk 31 such as a CD-ROM or other optical media. The
13 magnetic hard disk drive 27, magnetic disk drive 28, and optical disk drive 30 are
14 connected to the system bus 23 by a hard disk drive interface 32, a magnetic disk drive-
15 interface 33, and an optical drive interface 34, respectively. The drives and their
16 associated computer-readable media provide nonvolatile storage of computer-executable
17 instructions, data structures, program modules and other data for the computer 20.
18 Although the exemplary environment described herein employs a magnetic hard disk 39, a
19 removable magnetic disk 29 and a removable optical disk 31, other types of computer
20 readable media for storing data can be used, including magnetic cassettes, flash memory
21 cards, digital video disks, Bernoulli cartridges, RAMs, ROMs, and the like.

22 Program code means comprising one or more program modules may be stored on
23 the hard disk 39, magnetic disk 29, optical disk 31, ROM 24 or RAM 25, including an
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1 operating system 35, one or more application programs 36, other program modules 37, and
2 program data 38. A user may enter commands and information into the computer 20
3 through keyboard 40, pointing device 42, or other input devices (not shown), such as a
4 microphone, joy stick, game pad, satellite dish, scanner, or the like. These and other input
5 devices are often connected to the processing unit 21 through a serial port interface 46
6 coupled to system bus 23. Alternatively, the input devices may be connected by other
7 interfaces, such as a parallel port, a game port or a universal serial bus (USB). A monitor
8 47 or another display device is also connected to system bus 23 via an interface, such as
9 video adapter 48. In addition to the monitor, personal computers typically include other
10 peripheral output devices (not shown), such as speakers and printers.

11 The computer 20 may operate in a networked environment using logical
12 connections to one or more remote computers, such as remote computers 49a and 49b.
13 Additionally, computer 20 may communicate with one or more mobile information devices
14 55 and 57, such as personal digital assistant's (PDA), pagers, telephones, Black Berries,
15 pocket PC's, consumer electronic devices, palm computers, and the like.

16 Remote computers 49a and 49b and mobile information devices 44 and 57 may
17 each be another personal computer, a server, a router, a network PC, a peer device or other
18 common network node, and typically includes many or all of the elements described above
19 relative to the computer 20, although only memory storage devices 50a and 50b and their
20 associated application programs 36a and 36b have been illustrated in Figure 1. The logical
21 connections depicted in Figure 1 include a local area network (LAN) 51 and a wide area
22 network (WAN) 52 that are presented here by way of example and not limitation. Such
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1 networking environments are commonplace in office-wide or enterprise-wide computer
2 networks, intranets and the Internet.

3 When used in a LAN networking environment, the computer 20 is connected to the
4 local network 51 through a network interface or adapter 53. When used in a WAN
5 networking environment, the computer 20 may include a modem 54, a wireless link, or
6 other means for establishing communications over the wide area network 52, such as the
7 Internet. The modem 54, which may be internal or external, is connected to the system bus
8 23 via the serial port interface 46. In a networked environment, program modules depicted
9 relative to the computer 20, or portions thereof, may be stored in the remote memory
10 storage device. It will be appreciated that the network connections shown are exemplary
11 and other means of establishing communications over wide area network 52 may be used.

12 The present invention is discussed herein with reference to a decision-support
13 system where patient data and information is gathered and analyzed with stored patient
14 data and information to generate decision-supported patient data. The system provides the
15 clinician with the decision-supported patient data, or optionally and summarized versions
16 of the decision-supported patient data, optionally in real-time or clinician perceived real-
17 time. Although discussion is made to the use of the present invention in a decision-
18 support system, it may be appreciated that the present invention is not limited to use with a
19 decision-support system, but may be used in various other systems.

20 Figure 2 is a block diagram illustrating a decision-support system implementing
21 one embodiment of the present invention. As shown, system 200 includes one or more
22 decision-support modules 210a-210n that communicate with one or more user modules
23 214a-214n via network 212. Optionally, as designated by dotted line, system 200 may

1 include a medical module 216 and a third-party module 218 with which decision-support
2 modules 210a-210n and user modules 214a-214n may communicate. Additionally,
3 medical module 216 and third-party module 218 may communicate one with another.

4 Through the configuration illustrated in Figure 2, a patient or clinician may input
5 information regarding the patient's health, medical conditions, billing information, and
6 past and current medical care, termed "patient data". Subsequently, system 200 may
7 evaluate this patient data to create data that assists the clinician in making a medical
8 diagnosis or medical care decision. Such data is termed "decision-supported patient data."

9 Optionally, the decision-supported patient data may be configured in the form of a
10 decision-supported progress note that assists the clinician in making a medical diagnosis of
11 medical care decision. The decision-supported progress note is a module, data file, record,
12 field, or one or more data storages that contain information and data that represents a
13 qualitative and quantitative analysis of the patient assessment process performed by the
14 decision-support module 210 and the clinician and the recommended plan of medical care
15 suggested by decision-support module 210. Such qualitative and quantitative analysis may
16 extend over a long period, such as with an outpatient situation, or over a shorter period,
17 such as with an inpatient situation.

18 In this manner, system 200 may gather and analyze stored patient data with input
19 patient data to generate decision-supported patient data, optionally, in real-time or
20 perceived real time. Although discussion is made to the use of the present invention in a
21 decision-support system, it may be appreciated that the novel features of the present
22 invention are not limited to use with a decision-support system but may be used in various
23 other systems.

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1 As illustrated in Figure 2, system 200 includes decision-support module 210.
2 Decision-support system 210, in one embodiment, allows a patient to store and access
3 patient data, while allowing a clinician to store, update, and access the patient data and
4 decision-supported patient data that contain information regarding the diagnosis and
5 treatment of various medical conditions. Additionally, the clinician may access a
6 knowledge base that includes data representative of the current expert medical knowledge
7 within a variety of medial areas that assists the clinician with the diagnosis and medical
8 care of the patient. The patient data, the decision-supported patient data, and the
9 knowledge base need not be incorporated within decision-support module 210, but may be
10 located remotely from decision-support module 210 and accessible by decision-support
11 module 210. For example, optional medical module 216, as illustrated by dotted lines,
12 may include one or more servers that store the patient data, the decision-supported patient
13 data, and the knowledge base.

14 Facilitating communication between decision-support modules 210a-210n, user
15 modules 214a-214n, and optionally medical module 216 is network 212. Network 212
16 may be a local area network (LAN) such as a hospital or clinic intranet, wide area network
17 (WAN), wireless network, packetized network, real-time network, and various other
18 networks known by one skilled in the art. Decision-support modules 210a-210n
19 communicate with network 212 via various types of communication line connections, such
20 as but not limited to, cable or cable modems, satellite, telephone lines, whether analog or
21 digitally based, the internet, DSL, G-Lite, wireless technology, infra-red (IR) technology,
22 other high-speed data connections, or any other suitable transmission technology or
23 medium. One skilled in the art may identify various other types of network and/or

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1 communication line connections that are capable of performing the desired function of
2 allowing decision-support modules 210a-210n to communicate with user modules 214a-
3 214n and optionally medical module 216.

4 Each user module 214a-214n communicates with decision-support module 210 to
5 allow a clinician or a patient to gather patient data and receive decision-supported patient
6 data or progress notes in real-time or perceived real-time. For example, the clinician
7 and/or patient may provide and receive data regarding the patient's general health,
8 exercise, eating, smoking, drinking, and drug habits, if any, and the like, while the clinician
9 may view current and past medical conditions, treatments, medications proscribed, family
10 history, genetic predispositions and microbial susceptibilities, and the like. The clinician,
11 therefore, may retrieve data from and transmit data to decision-support modules 210a-
12 210n, optionally in real-time or perceived real-time and receive from decision-support
13 modules 210a-210n medical diagnoses and medical care recommendations, optionally in
14 real-time or perceived real-time.

15 As discussed herein, the operation of either transmitting data and/or receiving data,
16 in various forms and types, shall be termed collectively as "transceiving" and tranceiving
17 data between decision-support module 210a-210n, user module 214a-214n, and medical
18 module 216 without a substantial delay between an input and a response is real-time or
19 perceived real-time communication.

20 The transceiving of patient data, decision-supported patient data, and decision-
21 supported progress notes between decision-support module 210 and user modules 214a-
22 214n is accomplished by synchronizing decision-support module 210 and user modules
23 214a-214n through a variety of communication line connections and synchronization

1 manners, such as wireless synchronization, direct dial synchronization, desktop
2 synchronization, or such others as known by one skilled in the art. Such synchronization
3 may optionally be continuous, substantially continuous, periodic, sporadic, or the like.

4 Those skilled in the art will appreciate that each user module 214a-214n may take
5 various configurations, including personal computers, hand-held devices, multi-processor
6 systems, microprocessor-based or programmable consumer electronic devices, telephones,
7 pagers, pocket PCs, network PCs, minicomputers, mainframe computers, and the like.
8 Such devices and user module 214a-214n may be considered mobile information devices.
9 Preferably, user module 214a-214n is a personal digital assistant (PDA). Generally,
10 therefore, each user module 214a-214n may include the structure and functionality of
11 computer 20 with associated application programs 36 and memory 22 to store the
12 application programs 36 and medical data and information.

13 Optional medical module 216 represents the various hardware and software
14 modules and components of a medical facility, such as a hospital, clinic, and the like. Each
15 medical facility may store business data, medical data, patient data, decision-supported
16 patient data, decision-supported progress notes, and the like. Medical module 216, in one
17 embodiment, includes various modules associated with the medical facility's intranet or
18 internal network that links various departments of a hospital or clinic. For example, the
19 departments may include radiology, the pharmacy, administration, the laboratories, and the
20 like. Additionally, medical module 216 may include the hardware and software modules
21 and components for medical module 216 to communicate with decision-support module
22 210 and user modules 214a-214n by a communication line connection known to one
23 skilled in the art in light of the teaching contained herein.

1 According to another aspect of the present invention, system 200 optionally
2 includes third party module 218. Third party module 218 represents the various other
3 modules that may communicate with decision-support module 210, user modules 214a-
4 214n, and medical module 216. For example, third party module 218 may represent a
5 medical provider, an insurance carrier, a referred clinician, a referring clinician, a third
6 party paging service, and the like. In this manner, a clinician may communicate with
7 outside sources to obtain approval for services and/or give information to the outside
8 sources. For example, system 200 may allow decision-support module 210 to
9 communicate with an insurance carrier, health care management organization (HMO), or
10 other similar health care provider to receive authority to give a recommended medical
11 treatment. One skilled in the art may identify various other third parties that may obtain
12 benefits from the present invention.

13 Generally, the configuration of system 200 facilitates the gathering of patient data
14 and delivery of decision-supported patient data to a clinician and patient. For example, if a
15 clinician is examining a patient for the first-time, i.e. a new outpatient, one or more of
16 decision-support modules 210a-210n analyze the medical information collected by system
17 200. The resultant diagnosis, if any, is subsequently transmitted to user module 214a-
18 214n. Additionally, decision-support modules 210a-210n transmit recommended
19 treatments, procedures, tests, therapeutic drugs, and the like, which a clinician may use to
20 treat the medical condition or prevent the onset of one or more other medical conditions.
21 Furthermore, decision-support module 210a-210n may deliver educational materials that
22 decision-support module 210a-210n identifies as appropriate for the patient, whether for
23 general health purposes or for a specific medical condition. For example, if the current
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1 medical condition of the patient suggests a potential for heart disease or a heart attack in
2 the future, decision-support module 210a-210n may generate educational literature directed
3 to helping the patient to change their eating, smoking, drinking, and exercising habits to
4 combat the potential for a heart attack or other heart related medical problems.

5 Alternatively, system 200 may be used in an "inpatient" setting. Decision-support
6 modules 210a-210n, therefore, may analyze the newly gathered patient data with the stored
7 patient data relating to the patient's previous or preexisting medical conditions. Upon
8 analyzing the relevant patient data decision-support modules 210a-210n deliver
9 recommended treatments, procedures, tests, therapeutic drugs, and the like to the clinician.
10 As with the outpatient situation, decision-support module 210a-210n may generate
11 educational literature related to the patient's medical condition. For example, if the patient
12 has recently given birth to a new baby, decision-support module 210a-210n may generate
13 materials related to care of a new-born and potential medical complications or emotional
14 problems that the mother may incur.

15 Optionally, system 200 may present the clinician or patient with a summarized
16 version of the available medical and non-medical data via user module 214a-214n. Such
17 medical and non-medical data provided to the clinician and the patient may include
18 warnings or alerts with respect to recommended treatments or potential medical conditions
19 of the patient. By summarizing the decision-support patient data, the clinician is not
20 bombarded with a large quantity of information through which he or she must search.
21 Rather, the clinician may view the current decision-supported patient data, i.e., recent
22 laboratory test results, vital statistics, current drug usage, and the like. In this fashion, the
23 clinician is given a simplified representation of the patient's medical condition based upon
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1 the current medical knowledge and the current patient data. Thus, medical costs are
2 reduced and a higher quality of medical care is provided to each patient.

3 Generally, decision-support modules 210a-210n of system 200, either solely or in
4 combination with medical module 216 may evaluate the stored patient data to generate
5 decision-supported patient data for each of the patients that the clinician is to examine
6 within a defined time period. In this manner, decision-support modules 210a-210n and
7 system 200 assists the clinician in the treatment of the patient. The decision-support nature
8 of the decision-supported patient data is such that suggested medical care
9 recommendations and drug regimes are automatically generated by decision-support
10 modules 210a-210n based upon each specific patient's needs, past and present medical
11 conditions, family history, and various other parameters as will be discussed herein and
12 that may be identified by one skilled in the art.

13 As illustrated in Figure 2, the configuration of system 200 facilitates the delivery of
14 patient data to the clinician in a standardized and reproducible manner. The clinician may
15 request real-time patient data from decision-support module 210, or medical module 216
16 on demand and receive the patient data in a standardized format. Such patient data may be
17 delivered to the clinician via user module 214a-214n and displayed to the clinician through
18 a browser or other user interface. Additionally, the configuration of system 200 facilities
19 the delivery of important or critical information and patient data to the clinician, whether in
20 a synchronized basis or upon the occurrence of an alerted event, such as when a patient has
21 heart attack or an adverse reaction to prescribed medication. In this manner, the clinician
22 is quickly informed of the progress of his or her patients.

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1 Generally, each of the modules, 210a-210n, 214a-214n, and 216 may be
2 incorporated within various types of computer 20, remote computers 49a, 49b, and mobile
3 information devices 55, 57 as depicted in Figure 1. Each module 210a-210n, 214a-214n,
4 and 216, therefore, may include system memory 22 and storage devices 50a and 50b, while
5 optionally including hard disk drive 27, magnetic disk drive 28, optical disk drive 30, and
6 associated interfaces 32, 33, and 34. Additionally, each module 210a-210n, 214a-214n,
7 and 216 may communicate one with another via a variety of different manners and
8 communication line connections. Hence, the functionality of each module 210a-210n,
9 214a-214n, and 216 may be incorporated within one or more of the other modules. For
10 example, the functionality of decision-support module 210a-210n and/or of user modules
11 214a-214n may be incorporated within medical module 216.

12 With reference to the more detailed schematic representation of one embodiment of
13 the present invention depicted in Figure 3, only a single decision-support module 210 and a
14 single user module 214 are depicted. The following discussion will relate to the interaction
15 between one decision-support module 210 and one user module 214. One skilled in the art
16 may appreciate, however, that a similar discussion may be recited for the interaction of
17 multiple decision-support modules 210a-210n and multiple user modules 214a-214n.

18 According to one embodiment of the present invention, decision-support module
19 210 includes a patient storage module 220. Patient storage module 220 stores the patient
20 data that may be used by the clinician in determining the medical care to be received by the
21 patient. As illustrated, patient storage module 220 includes one or more databases 222a-
222n that maintain the patient data. Each database 222a-222n may have various
23 architectures, such as but not limited to, relational, network, flat, and hierarchical
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1 databases, with associated database management systems (not shown) that control the flow
2 of data to and from databases 222a-222n. Although multiple databases are represented,
3 one skilled in the art may appreciate that system 200 may include a single database.

4 The patient data maintained in databases 222a-222n may include, but is not limited
5 to, the patient's billing information (e.g., name, address, telephone number, birth data,
6 social security number, and insurance information) and patient's demographic information
7 (e.g., age, sex, height, and weight). Additionally, databases 222a-222n include past and
8 current: (i) medical conditions; (ii) medical care; (iii) tracked cure and failure information;
9 (iv) medications prescribed and associated adverse effects of drug interactions; (v)
10 laboratory tests and results; (vi) clinical consequences of treatment; (vii) family histories;
11 (viii) genetic predispositions; (ix) decision-supported patient data and progress notes; (x)
12 microbial susceptibilities, and the like. Such data may be stored in a variety of different
13 fields, files, and records that are associated one with another to allow an appropriate
14 database management system (not shown) to access the stored data in an efficient manner.

15 In addition to the above-recited data stored within databases 222a-222n, decision-
16 support module 210 may store pharmacogenomic data of the patient and the patient's
17 family to aid with the selection of medical treatment modalities. This allows decision-
18 support module 210 to use the patient's genetic structure to define responses to prescribed
19 drugs and provides a more useful medical treatment recommendation. For example, a
20 patient may be found through genetic testing to lack an enzyme necessary for a particular
21 drug's metabolism. Hence, decision support module 210 would use such
22 pharmacogenomic information to suggest an alternative drug that avoids toxicity and

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1 treatment failure, while being consistent with the patient's condition and pertinent medical
2 parameters.

3 In accordance with another aspect of the present invention, decision-support
4 module 210 includes a knowledge module 226. Knowledge module 226, and associated
5 databases 228a-228n, is the repository of the medical information, data, and associated
6 rules and parameter descriptions i.e., "knowledge", which decision-support module 210
7 uses to identify an unknown medical condition of a patient that is examined by the
8 clinician. Alternatively, the "knowledge" may be used to treat a known medical condition,
9 such as a terminal medical condition or non-curable medical condition.

10 The medical information and data stored within knowledge module 226 is based on
11 information from experts within the relevant fields of medicine, such as such as Geriatric
12 Medicine, Genetic Medicine and Gene Therapy, Cardiovascular diseases, Respiratory
13 diseases, and the like. Therefore, knowledge module 226 includes information related to,
14 but not limited to the following: Critical Care Medicine, Renal diseases, Genitourinary
15 diseases, Gastrointestinal diseases, Diseases of the liver, gallbladder, and bile ducts,
16 Hematologic diseases, Oncology, Metabolic diseases, Nutritional diseases, Endocrine
17 diseases, Women's Health, Diseases of bone and bone mineral metabolism, Diseases of the
18 immune system, Musculoskeletal and connective tissue diseases, Infectious diseases, HIV
19 and Acquired immunodeficiency syndrome, Diseases of protozoa and metazoa,
20 Neurological Diseases, Eye, Ear, Nose, and Throat diseases, Skin diseases, Pediatric
21 Medicine, and the like.

22 The rules and parameter descriptions stored in knowledge module 226 may include
23 one or more software modules, files, and records that define how decision-support module

1 210 uses the expert information to analyze the patient's current medical information. In
2 this manner, the clinician is guided with the identification and treatment of a patient's
3 medical condition. Such rules and parameters are dynamic in that as system 200 gathers
4 more "knowledge" the rules and parameters changes to accommodate the increased
5 knowledge. This is in contrast to many existing expert systems that utilize hard coded
6 rules and parameters that are difficult to vary based upon an increasing knowledge base.

7 As with databases 222a-222n, each database 228a-228n may have various
8 architectures, such as but not limited to, relational, network, flat, and hierarchical
9 databases, with associated database management systems (not shown) that control the flow
10 of data to and from databases 228a-228n.

11 Although Figure 3 illustrates each database 222a-222n and 228a-228n being
12 incorporated within decision-support module 210, one skilled in the art may appreciate that
13 such databases 222a-222n and 228a-228n and/or patient storage module 220 and
14 knowledge module 226 may be remotely located from decision-support module 210
15 Alternatively, in one configuration, patient storage module 220 and/or databases 222a-
16 222n may be incorporated within a hospital or clinic's administrative system and/or
17 network that allow decision-support module 210 to access the information stored therein.
18 In another configuration, patient storage module 220 and/or databases 222a-222n are
19 located remotely from decision-support module 210 and a hospital or clinic's
20 administrative system and/or network.

21 Communicating with patient storage module 220 and/or knowledge module 226 is
22 an intermediate module 230. Intermediate module 230 facilitates the decision-making
23 process by providing one or more modules that interact with patient storage module 220

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1 and/or knowledge module 226 to generate a medical condition diagnosis and medical care
2 recommendations for the clinician. In one embodiment of the present invention,
3 intermediate module 230 is a middle tier application server. It may be appreciated by one
4 skilled in the art that intermediate module 230 may have various other configurations. For
5 example, intermediate module 230 may be an application server integrally formed with
6 medical module 216.

7 Intermediate module 230 includes, in one embodiment, an inference module 232.
8 Inference module 232 controls the manner by which decision-support module 210
9 generates solutions to the medical condition of the patient, whether the information and
10 data to make such solution is gathered and/or stored patient data and information contained
11 within the knowledge module 226. Inference module 232 includes an inference engine that
12 is commonly known by those skilled in the art. Inference module 232 communicates with
13 patient storage module 220 and/or knowledge module 226 through a variety of different
14 interfaces such as those developed with Enterprise Java Beans (EJB), Common Object
15 Request Broker Architecture (COBRA), and Common Object Model (COM) compliant
16 services. It may be appreciated that a variety of different software modules and services
17 may be used to allow inference module 232 to communicate with patient storage module
18 220 and/or knowledge module 226.

19 Although inference module 232 is depicted as being incorporated within
20 intermediate module 230 of decision-support module 210, one skilled in the art may
21 appreciate that inference module 232 may be integrated into medical module 216 by
22 connecting intermediate module 230 directly to medical module 216 by an Internet Inter-

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1 Object Request Broker Protocol (IIOP) or remotely by a Remote Method Invocation
2 (RMI).

3 According to another aspect of the present invention, intermediate module 230
4 optionally includes interface modules 234a-234n. Interface modules 234a-234n allow
5 intermediate module 230 and hence decision-support module 210 to communicate with
6 medical module 216 and obtain patient data therefrom. Such communication may be via a
7 variety of communication protocols and communication line connections. In one
8 illustrative embodiment, interface module 234a allows communication via the Health
9 Level 7 protocol, while interface module 234n allows communication between decision-
10 support module 210 and medical module 216 via Extensible Markup Language (XML). It
11 may be appreciated by one skilled in the art that various other protocols and
12 communication line connections may allow communication between decision-support
13 module 210 and medical module 216.

14 Intermediate module 230 further includes an application module 236. Application
15 module 236 represents the various application programs that may be used by intermediate
16 module 230 to facilitate the decision-making process to diagnose a medical treatment and
17 provide guidance as to recommended medical procedures or treatments. For example,
18 application module 236 may includes software to drive the decision-support process and
19 more specifically to drive the decision made by inference module 232. In another
20 configuration, application module 236 includes a progress note module that manipulates
21 the decision-supported patient data into a decision-supported progress note that represents
22 the a qualitative and quantitative analysis of the patient assessment process performed by
23 the decision-support module 210 and the clinician and the recommended plan of medical

1 care suggested by decision-support module 210. Such qualitative and quantitative analysis
2 may extend over a long period, such as with an outpatient situation, or over a shorter
3 period, such as with an inpatient situation.

4 To allow intermediate module 230 to transceive information to and from user
5 module 214, one embodiment of the present invention optionally includes a web module
6 240. Web module 240 may be a web server that facilitates data transceiving between
7 decision-support module 210 and user module 214. Web module 240 may transceive
8 information and data via Hypertext Transfer Protocol (HTTP), File Transfer Protocol
9 (FTP), Wireless Application Protocol (WAP), or various other communication protocols
10 and communication line connections. For example, web module 240 may use TCP/IP
11 communication protocol, a connection orientated or connectionless network protocol, via
12 asynchronous transfer mode (ATM) technology, X.25 protocol, Frame Relay protocol,
13 packet switching protocols, circuit switching protocols, dynamic packet switching
14 protocols, 802.11RF protocol, home network protocols, and the like to transceive data
15 through network 212. Therefore, web server 240 and hence decision-support module 210
16 may use a variety of different interface types, such as but not limited to a wireless interface
17 thereby utilizing IR, RF, satellite, blue tooth transmission and associated protocols, a
18 modem, cable modem, ADSL connection, ISDN, Ethernet, or similar other connections,
19 and the like.

20 One skilled in the art may appreciate that inclusion of web module 240 within
21 decision-support module 210 is optional. In the event that decision-support module 210 is
22 partially or completely incorporated within medical module 216, decision-support module
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1 210 is devoid of web module 240 and may utilize a web module incorporated within
2 medical module 216 to allow communication with user module 214 via network 212.

3 Referring again to Figure 3, communicating with decision-support module 212 is
4 user module 214. User module 214 is preferably a personal digital assistant (PDA) or
5 other hand-held hardware device, including, but not limited to, a Palm Pilot, or CE based
6 palm computer, with associated software applications and operating systems. Therefore,
7 user module 214 may be a computer 20 and/or remote computer 49a and 49b that allows a
8 clinician and/or patient to gather and view medical information and associated medical
9 diagnosis and treatments.

10 User module 214, in one embodiment, includes a communication interface 242, a
11 control module 244, and a user interface 246. Communication interface 242 may
12 transceive data between decision-support module 210, medical module 216, and user
13 module 214. Communication interface 242, therefore, may transcribe data, compress and
14 decompress data, encrypt and decrypt data, and the like. Alternatively, the above-
15 described operations may be performed by a combination of communication interface 242
16 and control module 244.

17 Depending on the type of communication line connection between user module 214
18 and network 212, and hence decision-support module 212 and optionally medical module
19 216, communication interface 242 may have a variety of configurations. One skilled in the
20 art may identify various other types of communication interface that are applicable in light
21 of the teaching contained herein. For example, communication interface 242 may be a
22 wireless interface thereby utilizing IR, RF, satellite, blue tooth transmission and associated
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1 protocols, a modem, cable modem, ADSL connection, ISDN, Ethernet, or similar other
2 connections, and the like.

3 As implied above, communication interface 242 communicates with control
4 module 244. Control module 244 performs a number of operations and functions to allow
5 a clinician and/or patient to gather patient data through user interface 246 and view
6 proposed diagnosis and recommended treatments or medical procedures by way of user
7 interface 246, such as the decision-supported patient data. Control module 244, therefore,
8 manages the flow of data: (i) to and from the clinician and/or patient; (ii) from data storage
9 module 248 to user interface 246; (iii) between user module 214 and decision-support
10 module 210; and (iv) optionally from medical module 216 to user module 214.

11 In addition to controlling the flow of patient data between the various modules and
12 components of system 200, control module 244 may control the configuration of user
13 interface 246. Stated another way, control module 244, in one embodiment, may receive
14 display instructions from the clinician regard how the decision-supported patient data and
15 decision-supported progress note received from decision-support module 210 are to be
16 displayed or arranged. Alternatively, control module 244 may either receive the decision-
17 supported patient data (or the decision-supported progress note) and convert the data into a
18 form consistent with the clinician's instructions or function with intermediate module 230
19 and web module 240 to generate the desired display.

20 In the later case, control module 244 may: (i) receive through communication
21 interface 242 the decision-supported patient data or the decision-supported progress note;
22 (ii) store the decision-supported patient data or the decision-supported progress note in
23 data storage module 248, decision-support module 210, and/or medical module 216; (iii)

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1 summarize the decision-supported patient data (or decision-supported progress note) in
2 accordance with the clinician's instructions to display the pertinent information to the
3 clinician; and (iv) display the summarized decision-supported patient data (or decision-
4 supported progress note) to the clinician through user interface 246.

5 Generally, the summarized decision-supported patient data contains the pertinent
6 information related to the current medical status of the patient. For example, if the patient
7 has diabetes the medical information received from decision-support module 210 will be
8 directed to the pertinent medical conditions associated with the patient's diabetes and
9 control module 244 will summarize the decision-supported patient data to recite the most
10 recently acquired pulse rate, blood pressure, blood sugar level, critical warnings and alerts,
11 and the like. Alternatively, when a therapeutic regimen is suggested, the summarized
12 decision-supported patient data includes drug name and type, dose, route, interval and
13 duration of therapy, critical alerts and warnings specific to the patient and the drug, patient
14 demographics, and the like.

15 In this manner, control module 244 provides the clinician with the pertinent patient
16 specific decision-supported patient data in a summarized arrangement requested by the
17 clinician. By summarizing the pertinent data, a clinician is more capable of treating a
18 patient in an efficient manner; with a reduction in the time required to perform normal
19 clinician activities.

20 According to another aspect of the present invention, control module 244 may
21 manage the flow of information gathered by a clinician and input into system 200 through
22 user interface 246. Control module 244, therefore, may receive changes to current medical
23 treatments and store the same in preparation for delivery to decision-support module 210.

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1 For example, a clinician performing "rounds" within a hospital may employ user
2 module 214 to track changes to medical treatment or proscribed medications made by the
3 clinician. Control module 244 causes such changes made to the medical treatments and/or
4 medications proscribed to be stored in data storage module 248. Such changes will be
5 subsequently transmitted to decision-support module 210 and medical module 216 upon
6 synchronizing of user module 214, such as hotsyncing user module 214 with decision-
7 support module 210 and/or medical module 216 through physically inserting user module
8 214, such as in the form of a PDA, within a cradle or alternatively synchronizing the stored
9 information by way of a wireless connection, satellite connection, IR connection, or such
10 other connection known by one skilled in the art in light of the teaching contained herein.

11 Control module 244 may include various hardware and/or software modules to
12 perform the above-referenced functions, such as but not limited to one or more micro-
13 controllers, central processing units, state machines, programmable logic arrays, network
14 logical arrays, or gates, ASIC processors, software-based controllers, combination logic,
15 combinations thereof, and a variety of other controllers known by one skilled in the art.
16 Control module 244 may communicate with communication interface 242, user interface
17 246, and data storage module 248 by a variety of connections, such as but not limited to
18 electrical communication, an analog or digital, wireless, optical, or various other types of
19 connection by way of one of a variety of communication line connections known by one
20 skilled in the art.

21 As referenced above, a clinician may update medical information through user
22 interface 246 and receive a graphical representation of all or a summarized version of the
23 available medical conditions, diagnosis, and treatments of a patient through the same user
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1 interface 246. User interface 246 may also allow a clinician and/or patient to define the
2 display configuration of the decision-supported patient data and other patient data that is
3 transmitted to user module 214 from decision-support module 210 and/or medical module
4 216. A clinician may, in one embodiment, select from a number of stored display
5 configurations, use the default display configuration, or generate a clinician specific
6 display configuration. No matter the particular display configuration selected by the
7 clinician, the particular display configuration assists a clinician in diagnosing, treating, and
8 providing medical care to the patient.

9 In one embodiment, user interface 246 is preferably a graphical user interface
10 (GUI), such as a web browser. One skilled in that art may identify various other interfaces
11 that are capable of performing the desired function of allowing a clinician and/or patient to
12 gather and subsequently view medical information. For example, user interface 246 may
13 be a textual, interactive, drop-down menu, voice activated, and the like interface. User
14 interface 246 may allow a user to select choices through pushing buttons, selecting icons,
15 scanning bar codes, vocalization of procedure codes or medical treatments, or through
16 some other method, system, hardware device, and/or software application known to one
17 skilled in the art.

18 Generally, user interface 246 and communication interface 242 may be developed
19 from a variety of software packages such as HTML, dynamic HTML (DHTML) (including
20 JavaScript, Cascading Style Sheets, Common Gateway Interface (CGI) scripts, cookies,
21 Java, ActiveX, Server-Side Includes (SSI)), and the like.

22 According to another aspect of the present invention, decision-support module 210
23 and user module 214 may communicate with medical module 216 via network 212.

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1 Medical module 216, as referenced above, may include various hardware and/or software
2 modules and components associated with a medical facility, such as a hospital or clinic, a
3 government agency, such as the Centers for Disease Control and Prevention (CDC), or
4 some other facility that may obtain a benefit of the present invention.

5 As depicted in Figure 3, medical module 216 optionally includes a web server 252
6 that communicates with network 212. Web server 252 provides content representative of
7 information stored in medical module 216 over network 212 to those hardware and/or
8 software modules that access web server 252. Upon receiving a request from a hardware
9 and/or software modules, such as user module 214 and decision-support module 210, web
10 server 252 provides the requested documents or information in an appropriate language,
11 such as Hyper Text Markup Language (HTML), XML, or some other language. Web
12 server 252 may provide the requested information via Secured Socket Layers (SSL)
13 protocol, a Virtual Private Network (VPN), asymmetric or symmetric encryption, or some
14 other security protocol or process known to one skilled in the art. One skilled in the art
15 may also recognize that although a single server is depicted as part of medical module 216,
16 medical module 216 may include a plurality of web servers 252.

17 Communicating with web server 252 is an application server 254. Application
18 server 254 provides the conduit between the information stored in medical module 216 and
19 any requests for such information through web server 252. Application server 254 acts as
20 an intermediary between the information or data storage and the hardware and/or software
21 modules that request access to the desired information. Application server 254 controls
22 access to such information. In the illustrated configuration of Figure 3, information from
23 the ancillary module 256 passes through application server 254 upon a request through
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1 web server 252 to access the medical information stored in the ancillary module 256.
2 Application server 254 may, optionally in combination with web server 252, authenticate
3 access rights to the requested information.

4 In an alternate configuration of the present invention, when decision-support
5 module 210 is partially or completely integrated within medical module 216, inference
6 module 232 of decision-support module 210 may be integrated into medical module 216
7 by connecting intermediate module 230 directly to application server 254 of medical
8 module 216 by an Internet Inter-Object Request Broker Protocol (IIOP) or remotely by a
9 Remote Method Invocation (RMI).

10 According to another aspect of the present invention, medical module 216 includes
11 ancillary module 256. Ancillary module 256 includes one or more other modules that
12 represent the various hardware and/or software modules of the individual departments
13 within the medical facility, such as the hospital or clinic, and their associated connection to
14 medical module 216 and network 212. As illustrated, ancillary module 256 may include a
15 pharmacy module 260, laboratory module 262, administration module 264, radiology 266,
16 and the like.

17 Pharmacy module 260 maintains information and data representative of drugs
18 requested and proscribed for each of a plurality of patients, whether a patient is an inpatient
19 or an outpatient. Laboratory module 262 maintains information and data representative of
20 the laboratory tests ordered and performed for each of a plurality of patients.
21 Administration module 264 maintains information and data representative of the billing
22 information and scheduling information associated with each of a plurality of patients.
23 Radiology module 266 maintains information and data representative of the Computed

1 Tomographic (CT) scans, fetal ultrasounds, magnetic resonance imaging (MRI),
2 mammographs, and X-rays, ordered and performed for each of a plurality of patients.

3 One skilled in the art may identify various other modules that may be included
4 within ancillary module 256. For example, ancillary module 256 may include computer
5 physician order entry systems, other order entry systems, and the like.

6 Figure 4 is a flow diagram representing the operational process of one embodiment
7 of the present invention. Figure 4 depicts the processes and methodology for transceiving
8 data in an inpatient setting between decision-support module 210 and/or medical module
9 216 and user module 214, such as when a clinician is performing "rounds" within a
10 hospital or other clinical facility. It may be appreciated, that the method steps described
11 herein are only illustrative of one method of performing the desired function.

12 Referring now to Figure 4, a description of the methodology of the present
13 invention shall be provided as it relates to obtaining decision-supported data by a clinician
14 in an inpatient setting. The methodology description makes reference to Figures 2 and 3,
15 thereby illustrating the method of processing data through the various illustrative modules
16 and components of the present invention.

17 Before a clinician begins "rounds", the clinician identifies each patient with whom
18 he or she will visit or examine, as represented by block 280. During this process the
19 clinician may synchronize or connect user module 214 with decision-support module 210
20 and/or medical module 216 (Figures 2 and 3). This may be achieved through various
21 communication line connections, such as but not limited to wireless, IR communication,
22 placing user module 214 within a cradle, and the like. In this manner, a clinician may
23 identify those patients that decision-support is required.

1 Upon selecting the patients to be visited or examined, decision-support module
2 210, either solely or in combination with medical module 216, gathers patient data for each
3 patient selected by the clinician, as represented by block 282. This may entail each or a
4 combination of the following: (i) searching patient module 220, with its associated
5 databases 222a-222n (Figure 3); (ii) searching one or more modules of ancillary module
6 256 (Figure 3) of medical module 216; and (iii) receiving patient data from the clinician
7 through user module 214.

8 Once decision-support module 210 gathers the patient data, inference module 232
9 of decision-support module 210 analyzes the patient data with the data stored within
10 knowledge module 226, as represented by block 284. This process may involve many
11 iterations to determine possible medical conditions, causes of medical conditions, potential
12 treatments, such as surgery, administration of a therapeutic drug, lifestyle change, or the
13 like, to define a recommended course of action. This may also entail verifying
14 authorization with an insurance carrier for particular recommend treatment. In the event
15 that an insurance carrier does not accept or will not pay for a recommended treatment,
16 decision-support module 210 reevaluates the decision-support process to determine
17 alternate courses of action for the particular patient.

18 Upon reaching a recommendation, whether a single recommendation or a ranked
19 list of recommendations, decision-support module 210 generates decision-supported
20 patient data specific for each patient on the list of patient's that the clinician is to visit or
21 examine, as represented by block 286. The decision-support patient data, generally,
22 includes all pertinent patient data that relate to the recommended treatments suggested by
23 decision-support module 210. For example, when a therapeutic regimen is suggested, the
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1 decision-supported patient data includes drug name and type, dose, route, interval and
2 duration of therapy, critical alerts and warnings specific to the patient and the drug, patient
3 demographics, and the like. Such information will be specific to each patient. For
4 example, the dose of the therapeutic drug may be defined by decision-support module 210
5 based upon the height, weight, age, gender, and past medical history of the patient.
6 Although the analysis performed by decision-support module 210 may not be illustrated or
7 displayed to the clinician, such information may be provided to the clinician via user
8 module 214 if requested by the clinician.

9 While the clinician remains connected to decision-support module 210, such as
10 when user module 214 is located within a cradle, or upon maintaining synchronization or
11 synchronizing or connecting of user module 214 with decision-support module 210 prior to
12 "rounds", decision-support module 210 delivers the decision-supported patient data to user
13 module 214 such that the patient data stored therein is updated, as represented by block
14 288.

15 As data is transferred to user module 214, decision-support module 210 identifies
16 whether a clinician has set display parameters for user interface 246 of user module 214, as
17 represented by decision block 290. For example, the clinician may vary the manner by
18 which user interface 246 displays the decision-supported patient data, thereby allowing a
19 clinician to organize patient data in a format that assists the clinician in providing medical
20 care to the patient. If the clinician has set display parameters, decision-support module 210
21 in cooperation with user module 214 organizes the decision-supported patient data in
22 accordance with the clinicians selections, as represented by block 292. Alternatively, if the
23 clinician has not set display parameters, decision-support module 210 in cooperation with

1 user module 214 organizes the decision-supported patient data in accordance with the
2 default display configuration, as represented by block 294.

3 It may be appreciated by one skilled in the art that decision-support module 210
4 may only deliver decision-supported patient data to user module 214 without assisting with
5 the selection of display configuration. User module 214 alone may review whether the
6 clinician has defined a clinician specific display configuration.

7 Upon receiving the required patient data (e.g., decision-supported patient data,
8 patient data, and other patient specific information) user module 214 is ready for use by the
9 clinician during the clinician's examination of the patients. The clinician may commence
10 his or her "rounds" by selecting the first patient with whom he or she will visit, as
11 represented by block 296. This may be achieved in a variety of manners depending on the
12 particular type of user interface. For example, a clinician may select a patient from a drop-
13 down menu, through a voice activated interface, pushing buttons, selecting icon
14 representations of each patient, or by one of a variety of other manners known by one
15 skilled in the art in light of the teaching contained herein.

16 Once the patient is selected, the clinician may perform his or her examination of the
17 patient, as represented by block 298. The examination may be a physical examination, a
18 question and answer session, or a combination thereof. Following the examination, the
19 clinician may update the information stored within user module 214, as represented by
20 block 300. Subsequently, the clinician maintains a connection or connects to decision-
21 support module 210 and/or medical module 216, either through a cradle located at the
22 patient's bed into which user module 214 is located or through a wireless connection, to
23 generate new decision-supported patient data with associated recommendations and

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1 treatments, as represented by block 302. Following receipt of the new decision-supported
2 patient data the clinician selects the desired medical treatment or regime.

3 Alternatively, instead of the clinician asking a number of questions as prompted by
4 the clinician's knowledge and information contained within the decision-supported patient
5 data, a patient may answer a number of questions posed through another user module
6 located at the patient's bed. In this manner, when the clinician examines the patient the
7 clinician merely has to select the desired medical treatment or regime, without connecting
8 to decision-support module 210 to obtain new decision-supported patient data. Hence,
9 steps related to connecting to decision-support module 210 to obtain new decision-
10 supported patient data are optional to the flow diagram depicted in Figure 4.

11 Once the desired medical treatment or regime is selected, a clinician may store the
12 new decision-supported patient data centrally within decision-support module 210 and/or
13 medical module 216, thereby updating the patient data stored therein, as represented by
14 decision block 304. If the clinician wishes to store this patient's data, user module 214
15 connects or synchronizes with decision-support module 210 and/or medical module 216,
16 either physically or through wireless or other remote connection, and updates the
17 information or data stored therein, as represented by block 306. In the event the clinician
18 does not wish to store the new decision-supported patient data centrally, user module 214
19 stores the new decision-supported patient data within data storage 248, as represented by
20 block 308.

21 Whether the new decision-supported patient data is stored centrally or locally, the
22 clinician may select other patients with whom he or she is to visit, as represented by
23 decision block 310. If the answer is in the affirmative, the clinician is asked to select a
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1 new patient, as represented by block 296. Subsequently, the clinician follows the same
2 data flow as represented by blocks 298 through 308. If the answer is in the negative, user
3 module 214 automatically or through user prompts connects or synchronizes with decision-
4 support module 210 and/or medical module 216, either physically or through wireless or
5 other remote connection, to update the information or data stored therein, as represented by
6 block 312. Such connection and/or synchronization may cause decision-support module
7 210 and/or medical module 216 to request functionality of ancillary module 256. For
8 example, in the event that the medical care recommended by the clinician requires
9 laboratory tests, user module 214 connects to laboratory module 262 to schedule such tests
10 and notifies the nurse or other clinician assistant to obtain the necessary blood or other
11 substances to perform the desired tests. Similarly, if a prescription medication is required,
12 user module 214 connects with pharmacy module 260 to obtain the medication.

13 In this manner a clinician is able to receive decision-supported patient data that
14 provides the clinician with recommendations as to potential medical conditions that each
15 patient with whom he or she may have and/or provide the clinician with updated current
16 patient data for those patients that the clinician is continually treating. By providing such
17 decision-supported patient data, the clinician is continually educated with current medical
18 knowledge from the extensive expert system incorporated within decision-support module
19 210 and/or medical module 216. This allows the clinician to provide medical care at the
20 cutting edge of the medical knowledge and the clinician is more capable of giving each
21 patient a high quality of medical care in an efficient manner.

22 According to another aspect of the present invention, user module 214 may be
23 continuously, substantially continuously, periodically, or sporadically connected or
24

1 synchronized with decision-support module 210 and/or medical module 216. User module
2 214 may then receive alert signals or messages from decision-support module 210 and
3 medical module 216 related to the patient's visited by the clinician. For example, the
4 clinician may receive an e-mail message on his or her mobile information device or user
5 module 214 identifying an emergency with his or her patient. Alternatively, the user
6 module 214 may receive a reminder to visit a particular patient at a particular time or
7 request information from decision-support module 210 and/or medical module 216 on
8 demand. In this manner, the clinician is quickly informed of the progress of his or her
9 patients.

10 The present invention may be embodied in other specific forms without departing
11 from its spirit or essential characteristics. For example, embodiments of the present
12 invention are also disclosed in copending United States Patent Application entitled
13 "Systems and Methods for Manipulating Medical Data Via a Decision Support System",
14 filed September 21, 2000, which is incorporated herein in its entirety by reference. The
15 described embodiments are to be considered in all respects only as illustrative and not
16 restrictive. The scope of the invention is, therefore, indicated by the appended claims
17 rather than by the foregoing description. All changes which come within the meaning and
18 range of equivalency of the claims are to be embraced within their scope.

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What is claimed and desired to be secured by United States Letters Patent is:

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